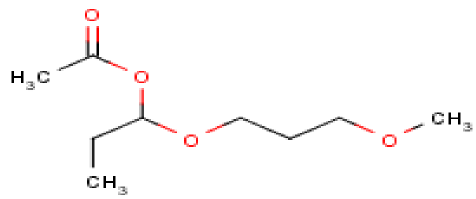
Dipropylene Glycol Methyl Ether Acetate

(CAS 88917-22-0)

Synonyms : 1-(2-methoxy-1-propoxy)-1-propan-2-ol; 1-methyl-(1-propoxy)-2-propanol acetate; 1(or 2)-(2-methoxymethylethoxy)-propanol acetate; Dowester A50B; DPMA)



Dipropylene Glycol Methyl Ether Acetate Acute REL

No studies were located that were appropriate for the development of an acute REL.

Dipropylene Glycol Methyl Ether Acetate 8-hour REL

Reference Exposure Level	**0.08 mg/m^3 (013 ppm)**
Critical effects	Organ weight, hematological change
Hazard Index target	Blood, kidneys

1 Physical and Chemical Properties of Dipropylene Glycol Methyl Ether Acetate

Description	colorless liquid
Molecular formula	$C_9H_{18}O_4$
Molecular weight	190.2 g/mol
Specific gravity	0.976 @ 25°C/25°C
Boiling point	208.9ºC
Melting point	-25.2ºC
Vapor pressure	0.13mm Hg @ 25ºC
Log Kow	0.803
Solubility	16 g/100 ml H_2O @ 25ºC
Atmospheric half-life	not found
Conversion factor	1 ppm = 7.77 mg/m^3 @ 25ºC [DPM: 1 ppm = 6.06 mg/m^3]

2 Production, Use, and Exposure

Because of its high solvency and coalescing abilities, and moderate evaporation rate, dipropylene glycol methyl ether acetate (DPMA) finds extensive use as a solvent in coatings and silkscreening inks. It is also used as a cleaning agent. Inhalation and dermal contact are likely during the applications of DPMA-containing coatings and during its use as a cleaning solvent.

3 Pharmacokinetics and Metabolism

In vivo, DPMA is expected to be rapidly hydrolyzed to dipropylene glycol methyl ether (DPM). As a class, propylene glycol ethers (PGE) are rapidly absorbed and distributed throughout the body. Metabolism in the liver is initiated by cleavage of the ether linkage by mixed function oxidases to form propylene oxide and an alcohol. Intermediary metabolism ultimately converts these to CO_2 and water.

The primary alcohol function on glycol ethers is easily oxidized by liver alcohol dehydrogenase (ADH). However, the isomer containing the primary alcohol is usually present in the racemic mixture at <5%. The propylene glycol ethers have a secondary alcohol function representing >95% of the racemic mix and are relatively poorer substrates for ADH. They undergo microsomal O-dealkylation to propylene glycol which is a substrate for conversion by ADH to lactic acid and further to pyruvic acid (Klaassen, 1996).

The EPIWIN/APO model (U.S. EPA) estimates that the atmospheric photodegradation half-life of TPM is 3.8 hours, based on 12 hours of sunlight/day and an average hydroxyl radical concentration of 1.5×10^6 OH/cm^3.

4 Toxicity of Dipropylene Glycol Methyl Ether Acetate

Data on the inhalation health effects of DPMA are scarce and largely limited to lethality studies. By analogy to other propylene glycol ethers, it is assumed to be less toxic than the equivalent ethylene glycol ethers.

Acute mammalian toxicity data were summarized in the Screening Information Data Set (SIDS) for DPMA (Table adapted from UNEP, 2003) as follows:

Acute rat oral LD_{50}	**Acute rat inhalation LC_{50} (4 hr)**	**Acute rat dermal LD_{50} (24 hr)**
Females 5,448 mg/kg (95% CL: 4071-7633 mg/kg) 2/6 died at 5,000 mg/mg Males > 5,000 mg/kg No deaths at this dose	> 5,700 mg/m^3 No deaths. Carreon et al., 1982	> 5,000 mg/kg No deaths. Carreon et al., 1982

In vivo, DPMA is expected to be rapidly hydrolyzed to dipropylene glycol methyl ether (DPM); thus, the in vivo effects of DPMA are expected to be the same as those of DPM. Mild symptoms of toxicity have been reported for laboratory animals exposed to DPM by inhalation including central nervous system depression, hepatic changes (enlargement), and decreases in body weight gain. In experiments lasting for 2 to 28 weeks, NOAELs were in the range of 50-400 ppm for rats. In a two-week experiment with mice, a NOEL of 50 ppm and a LOEL of 140 ppm were reported by Landry and Yano(1981) in UNEP (2003) for increased liver weight without histopathology.

In a subchronic inhalation study by Landry and Yano (1984), rats and rabbits were exposed to 0, 15, 50, or 200 ppm of DPM (mixed isomers) for 6 h/day, 5 d /wk for 13 weeks. Body and organ weights, gross necropsy and histopathology, as well as blood chemistry were evaluated. No dose related effects were reported from the hematological evaluation. There were no significant differences in organ or body weights among the rats. However, among the seven female rabbits, a significant ($p < 0.05$) increase in kidney weights at 50 and 200 ppm was reported. The authors suggest that since there was no attendant evidence of nephrotoxicity and the kidney weights were within the range for historical controls, these effects were unrelated to treatment. However, in the context of this experiment, these results suggest potentially pathological changes that may impair kidney function.

The NIOSH REL and the OSHA PEL values are both 100 ppm.

5 Derivation of Interim RELs

The subchronic study of Landry and Yano (1984) is the basis for the 8-hr REL. The observation of kidney changes at 50 and 200 ppm suggests a LOAEL of 50 ppm and a NOAEL of 15 ppm.

5.1 Acute REL (1-hour exposure) for DPMA as DPM

No studies of short-term exposure to DPMA were located. While an LC_{50} was reported, this value represents the upper limit for acute exposures that are compatible with survival without regard to protecting health. As such they are not the preferred basis for the derivation of an acute REL, which requires consideration of effects much less severe than lethality.

In the course of an 8-hour exposure, intermittent spikes in exposure levels are included in the time-weighted average addressed with the 8-hr REL. The values associated with 8-hr RELs are typically lower than allowed for acute 1-hr exposures, due to the longer exposure duration and possibility of recurring exposures. Therefore application of the 8-hr REL to exposure scenarios involving short-term peaks in concentration should be health protective in most cases.

5.2 Derivation of 8-hr REL for DPMA as DPM

Study	Landry & Yano, 1984
Study population	Rats and rabbits
Exposure method	Chamber/whole body exposure
Exposure continuity	6 h/d, 5 d/wk
Exposure duration	13 wk
Critical effects	Organ weight
LOAEL	50 ppm
NOAEL	15 ppm
Time-adjusted exposure	C*T
Extrapolated concentration	8 ppm (15*6/8*5d/7d)
Human concentration adjustment	8 ppm (RGDR = 1; systemic effects)
LOAEL uncertainty factor	1 (NOAEL observed)
Subchronic uncertainty factor	√10
Interspecies uncertainty factor	
Toxicokinetic (UF_{A-k})	2
Toxicodynamic (UF_{A-d})	√10
Intraspecies uncertainty factor	
Toxicokinetic (UF_{H-k})	10
Toxicodynamic (UF_{H-d})	√10
Cumulative uncertainty factor	600
8-hour Reference Exposure level	**0.08 mg/m^3 (0.013 ppm)**

For the 8-hr REL, 15 ppm is used as a NOAEL. Time adjustment is achieved with Haber's relationship (C*T) to give a concentration of 8 ppm. The interspecies toxicokinetic and toxicodynamic UFs are √10 each. These values reflect the assumption that the interspecies variability in the absorption, distribution, metabolism and excretion of this substance will not be large. However an intraspecies toxicokinetic UF of 10 is applied to reflect enzymatic and other variability among infants and children compared to adults. This gives a cumulative UF of 600 and an 8-hr REL of 0.013 ppm.

6. Other toxicity

Developmental toxicity of DPM in rabbits and rats following inhalation of 0, 50, 150, or 300 ppm 6 hr/day on gestation days 7-19 (rabbits) or 6-15 (rats) was evaluated in fetuses taken on days 28 (rabbits) and 21 (rats). Gross anatomical inspection revealed no significant treatment-related external, visceral, or skeletal alterations in either species at any dose. There were no reported maternal effects based on maternal weight gain, liver weight, food and water consumption, or behavior. No evidence of embryo or fetotoxicity was reported (Breslin et al., 1990).

7. References

Breslin W, Cieszlak F, Zablotny C, Corley R, Yano B and Verschuuren H (1990). Developmental toxicity of inhaled dipropylene glycol monomethyl ether (DPGME) in rabbits and rats. The Toxicologist 10: 39.

Klaassen C, ed. (1996). Casarett and Doull's Toxicology; The basic science of poisons. McGraw-Hill New York. 1111

Landry TD and Yano BL (1984). Dipropylene glycol monomethyl ether: a 13-week inhalation toxicity study in rats and rabbits. Fundam Appl Toxicol 4(4): 612-7.

UNEP. (2003). Screening information data set for propylene glycol ethers. Organisation for Economic Co-operation and Development. Arona, Italy